Usability Evaluation in an Exploratory Design-Based Research Approach of Convenience Store New Employee Training e-Learning Material

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Abstract

A large number of organizations have adopted e-Learning programs, and far fewer have addressed the usability of their learning applications. To ensure the quality of e-Learning training material, we utilized the usability evaluation heuristic in the design and development processes. The application of exploratory, and usability evaluations during the design-based research study is described. Additionally, participant selection, data collection and analysis; and results relevant to usability portions of this study are presented.

1. Introduction

Today e-learning is the most recent way to carry out distance education by distributing learning material and process over the Internet. E-learning has the capability to provide on-demand training that transcends geographic and time boundaries. Therefore, it's no surprise that a large percentage of organizations have actively developed and implemented online learning programs. Chou, Chang, and Fu [3] asserted that the advantages of e-Learning in organizations include improving the efficiency of learning among organizational members, enhancing competitiveness of organizations, and minimizing training costs. The e-Learning application in Taiwan focuses on on-the-job training in organizations, among which the utilization of e-Learning in convenience stores new employee training can especially help resolve the problem of insufficient training due to high number of staff and fast turnover. Furthermore, another crucial key to success lies in the creation of a convenient learning environment that efficiently imparts knowledge and skills to employees. In light of the circumstance, e-Learning has become a tool that can enhance performance anytime, anywhere.

2. Usability in e-Learning

A large number of organizations have adopted e-Learning programs, far fewer have addressed the usability of their learning applications. If an e-Learning application is not usable enough, it hampers users' learning; the

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learners would not spend more time learning the contents [5]. In another word, a poorly designed interface will make learners feel lost, confused, or frustrated, it will hinder effective learning and information retention. Since usability plays a vital role for the success of e-Learning, it is an important issue for the e-Learning applications developers to ensure usability and accessibility to the users.

Usability has been defined by some as the extent to which an application is learnable and allows users to accomplish specified goals efficiently, effectively, and with a high degree of satisfaction [8, 10]. An additional component that should be added to this definition is usefulness; that is, a highly usable application will not be embraced by users if it fails to contain content that is relevant and meaningful to them [8]. Moreover, Nielsen [11, 12] states that usability spans five categories, three of which are relevant to this work: (a) Efficiency: assuming that I know how to use an artifact, how quickly will I perform tasks? (b) Errors: how many errors do I make, how severe are these errors, and how easily can I recover from the errors? (c). Satisfaction: how pleasant is it to use the artifact?

3. Overview of this study

The purpose of this study is to (1) explore the practice of convenience store new employees' training in Taiwan (2) develop e-Learning training material according to the design principles for successful convenience store new employees' performance in their workforce (3) evaluate the effectiveness of the new employee training material. Research and development are organized into four phrases and completed during in a two-year period. Three versions of this e-Learning new employee training material were created: prototype, alpha, and beta.

Research and development in this study was guided by the design-based research approach [19]. The concept of progress refinement of design-based research approach is linked to the usability evaluation process [9]. What difference is between formative evaluation and usability evaluation during the design-based approach? From Scholtz' point of view [18], formative evaluation is more about design than taking actual measurements regarding the usability. And, user testing is defined with the goal of learning about design to improve its next iteration [11]. Moreover, Gould [6] also mentioned that formative evaluation should start early and continue throughout the design and development process of e-learning media. Based on literature reviews [16, 9], usability evaluation in this study were tied to each phase of design based research as shown in figure 1.

The first phase of the process in this study was to conduct needs assessment. The main purpose of needs assessment is to characterize the target audiences and to identify the critical needs that the proposed the interactive learning approach is intended to meet [14]. After interviewing the owner of one convenience store and analyzing questionnaires collected from the employees, we discovered that the new employee training should emphasize three aspects: receiving and checking in merchandises, checking out customers, and heating up food.

Therefore, the second step of this process was to conduct formative evaluations of prototype during the design phase. In regards to content and design principles [2], the designers were able to review the feedback from the formative evaluations. After the initial design and development was created and viewable, the usability evaluation was conducted. Generally speaking, the main purpose of formative usability evaluation is to get quick feedback in order to iterate the design and interaction in the earlier conceptual design and development stages [15].

The third step in this process was to "debug" and "enhance" the alpha version of the

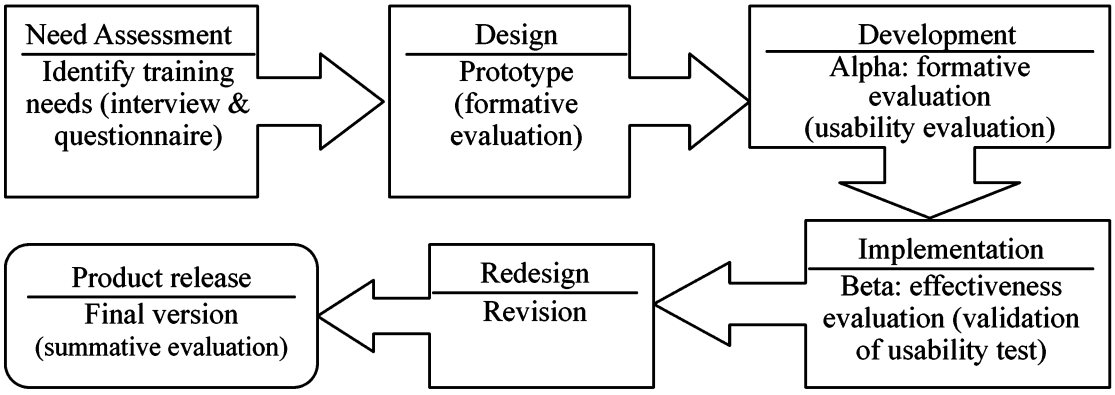

Figure 1: e-Learning training material development process adopted from DBR (Wang & Hannafin, 2005; Peterson, & Olney, 2009)

e-Learning convenience store new employee training material during the development phase. To ensure the development quality of e-Learning training material, we conducted the effectiveness evaluation whether the e-Learning training material accomplishes its objectives within immediate or short-term context of its implementation [14]. Following formative evaluations, and step 4, the effectiveness evaluation of the beta version, is conducted during the implementation phase.

3.1 Participant selection

According to Barnum [1], five participants are enough to receive productive feedback in a usability evaluation. Participants in this study were carefully chosen to capture different characteristics of majors, including grade levels, and gender in the background. In the development process of this study, 4 participants were selected for alpha version of usability testing, and in the implementation process, 8 participants were selected for beta version of usability testing. Nine of participants used to work at convenience stores; the remaining participants were interested in pursuing a job in the field. Six of participants are female, and the rest are male.

3.2 Method & procedure

The usability testing included three stages: 1) Introduce users to the usability testing lab and testing procedure. The test experimenter debriefed users before the testing. 2) Conduct task analysis. After the testing began, the test experimenter announced the tasks for users to complete. Users were asked to talk out loud while they perform the tasks. The test experimenter recorded users' responses and prompted users to speak out when needed, but did not give feedback. 3) Interview users. After the tasks were performed, the test experimenter reviewed the session with users and gathered additional feedback.

In order to identify the main features of the interaction with e-learning materials, we have performed two usability tests. After the alpha and beta versions of the e-Learning training material were developed, we used Morae software to conduct usability testing. Throughout the testing, the test experimenter observed each user separately and used Morae to record the whole process. The testing focused on eight aspects: 1) Was the instruction sufficient in terms of the content? 2) What were users' thoughts on the way instruction was presented? 3) Did the design elements provide obvious guidance? 4) Could learners navigate design elements easily? 5) Were the functions of design elements clearly marked? 6) Did the design elements help users to understand the instructional content? 7) Could learners comprehend the instructional content when audio and video multimedia was presented? 8) Were there design elements or content that may be neglected?

4. Results of Usability Testing

Since the focus of this paper on usability only,

Table 1: Problem matrix for the analysis of usability findings

Version	Tasks/Scenes	Design elements	Problems/ Recommendations	Retest required	Fixed
alpha	•checking out customers	•manual instruction •icon guidance design •animations display	•confusion about how to operate the cashier machine without manual	R/C	X
			• some bottoms of menu icon didn't work	R/C	X
			•5 programming bugs	R/C	P
alpha	•heating up food	• icon guidance design	• 'next' bottoms did not work	R/C	X
alpha	•receiving and checking merchandize	•navigation	• some icon linking errors	R/C	X
beta	•checking out customers	•animations display •the scenario design	• 2 programming bugs • confusion about how to operate the cashing machine	R	P
			• add some more complicated scenario situations for practice		
beta	•receiving and checking merchandize	•information feedback	•lack a clear information feedback for scenario practice	R/C	X
		•the scenario design	• add some more complicated scenario situations for practice		

follow-up interview and usability evaluation data sources are discussed in this section. Findings were gathered from two usability evaluations (alpha version & beta version) and entered into a problem/solution matrix (see Table 1). The terms used in the matrix were defined as follows:

- Version: e-learning material version used for the testing (alpha, or beta)
- Task/scene: Activity or scenario completed by the participant during which the usability problem was identified. Totally, there are 10 tasks in three main aspects (receiving and checking in merchandises, checking out customers, and heating up food) of the e-Learning training material.
- Retest required: A 'Y' means that a retest is required during future usability sessions to confirm that the solutions was effective, and a 'C' means that retest was completed.
- Fixed: An 'X' means that the problem was fully corrected, and a 'p' means that it was partial corrected.

Out of 28 total usability problems identified, 91% were either fixed or partially fixed. Usability results also indicated that certain modification to beta version of e-Learning material were needed. Such modifications included the improved the manual instruction regarding the process of operating cashing machine and edited the information feedback about the scenario practice. Another modification needed was functionally that would allow users to operate the cashing machine, in the aspect of checking out the merchandise of e-learning material, very smoothly without programming bugs. Moreover, there is a recommendation regarding the development of more complicated scenarios practices for trainees. To fulfill the true needs of users, we will conduct the training experts, in the human development field of convenience chain store, whether to add more complicated scenarios in the redesign phase (Figure 1) for new employee training e-learning material.

The interview and usability evaluation sessions worked well for this study. The interview guide approach was also effective. With this approach, questions to be explored are outline in advance. Interviewers could decide the sequence and wording of questions during the process of the interview if time became an issue. In the usability testing, we not only focused on the extent which how effectiveness and efficiency of the e-Learning material perform, but also emphasized the extent which how pleasant users feel. Some of the questions asked included: a). what would you like and dislike about the e-Learning material? b). how easily do you navigate through the e-learning material? c). which design elements of e-learning material make you feel frustrated? d). overall, how do you feel satisfied about the e-Learning material that can enhance your skills and knowledge about working at convenience store (rank from 1(totally unsatisfied) to 5 (totally satisfied)? However, from the follow-up interviews, the 12 users agreed that the e-Learning instruction could enhance learner motivation and interests as well as increase new employees' skills. Except parts of the programming needed to be debugged, users held positive attitudes toward the e-Learning material.

5. Conclusion

Usability evaluations in this study informed the convenience store new employee training e-Learning material in two central ways: 1).by ensuring the product features matched the needs of target users and 2). identifying usability deficiencies. Usability findings from the design and research of the e-Learning material were presented. The informal usability evaluation conceptualized with interviews could be still part of this phase 4 of research, but formal usability evaluation could also be conducted.

We hope this study can provide an example for professionals who are interested in developing e-Learning materials. Rubin, Chisnell, & Spool [17] encouraged an iterative cycle of usability evaluation and urged that after a design has been finalized and put into use, the most accurate appraisals of usability can be achieved because of the actual users, product and environment. In the future, in order to achieve the accurate appraisals of usability, a follow-up study for the new employee training e-Learning material has been proposed that would take the form of a formal impact evaluation.

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